DEPARTMENT OF NOTES, REVIEWS, ETC.

It is the purpose, in this department, to present from time to time brief original notes, both of methods of work and of results, by members of the Society. All members are invited to submit such items. In the absence of these there will be given a few brief abstracts of recent work of more general interest to students and teachers. There will be no attempt to make these abstracts exhaustive. They will illustrate progress without attempting to define it, and will thus give to the teacher current illustrations, and to the isolated student suggestions of suitable fields of investigation.—[Editor.]

NOTES ON SOME PECULIAR SENSE ORGANS FROM DIPTERA

The Diptera are generally conceded to be descended from four-winged ancestors, the posterior pair of wings having become rudimentary. The rudiments of this posterior pair of wings are called halteres, and are found as small club-shaped organs just back of the normal wings.

These organs play an important part in the orientation of the body during flight. If they are removed or otherwise interfered with, the flight is disturbed and in some cases prevented.

At the base of the stalks of the halteres are to be found some highly developed organs, which appear to be sense organs.

In Figs. 1 and 2 which are drawn from an Ortalid, called *Stranzia longipenis,* will be seen a dorsal and a lateral view of a halter. There are apparently two kinds of sense organs depicted here, one (A) and (C) situated on opposite sides of the stalk, and one (B) situated on the chitinous sheath which covers the base of the organ on the dorsal side. (See Plate I).

Fig. 2 shows a side view of the halter. These sense organs when viewed with a higher power present an appearance something like Fig. 3. There are ten rows of the oval disks, with as many rows of rudimentary hairs or spines between them. Organs (A) and (C) are identical in these particulars. These oval disks have a swelled or crowning surface, which leaves them distinctly raised in rows.

In Fig. 4, is a diagram of the disk arrangement of the basal sheath. Here the disks lie in rows between chitin ridges, those nearest the center being nearly overgrown with small spines.

An explanation of the nature and function of these organs is not certain nor easy. The following is offered as suggestive.

Let us look for a moment at the more primitive type of fly; we may find here a clue to the course these structures may have followed in their evolutionary degeneration.

In the Brachycera, we find a type of insect which has very simple forms of wings, the venation being mostly absent except for a few parallel ribs which run lengthwise of the wing. The wings are covered with spines which lie in rows alternating with each other as in Fig. 7. The halteres still retain their wing shape and the spines on them preserve the arrangement found on the anterior wings.

In another family still more highly organized, we find the rows of spines more definitely gathered and specialized into rows, which rows of spines are separated by spaces such as are seen in Fig. 5.

Finally, in the elaborate organization of the soaring and poising flies we find, as described above for Stranzia, the rows of hairs or spines alternating with the rows of disks. Microtome sections of these organs show the oval disks as hollow and filled with fluid during life.

The rows of degenerate spines seem to be connected with the central nervous system, and are assumed to be sensory.

From a histological standpoint the halter is composed of an ectodermal layer of cells, which secretes the chitin with its many sensory spines, and an interior mass composed of trachea, nerves, and fluids with corpuscles. See Fig. 9 for a very diagrammatic view of a section of the halter.

Fig. 8 is a much enlarged view of the cells in the sense organ on the stalk of the halter. The disks are formed from large oval cells (A), and the sensory cells are at (B).

The writer is unable to say whether the disc cells are also sensory; altho it is possible that they are. It seems at least probable to him that they may be considered as homologous with the ordinary smooth membrane interspinal spaces on the normal wing. It is not clear from the structure of these organs just how they contribute to equilibrium, unless in some way they control the blood supply to the vascular terminal bulb.

Some experiments conducted to determine what relation these sense organs on the halteres have to flight and to orientation in flight may prove interesting to those who have not made special study of the subject.

In order to determine the relation of the halteres to flight the writer removed the entire halteres, by cutting, in a number of specimens of Muscidæ. Flies so treated were all incapable of controlling their flight, usually pitching violently downward when attempting to fly.

A similar number of flies was taken, and, without removing the halteres, a small amount of liquid balsam was introduced under the sheath and over the sense organs. Specimens treated in this way could not be induced to undertake flight.

These two experiments show clearly that the halteres play an important role in equilibrium in flight, and that they can be put out of commission, as effective organs, without actual removal. This suggests the existence of certain subordinate parts on which the functioning of the organ depends.

It now remains to localize, if possible, the responsible portion of the halter. In doing this, larger flies, as Sarcophagidæ, Syrphidæ, and Tachinidæ, were used. An effort was made in these flies to injure the structures referred to above as sense organs, and to confine the injury to these. Cauterization with a hot needle was attempted; but this was difficult to control, and often resulted in too extensive a wound. The other method used was the application to the so-called sense organs of a small amount of nitric or sulphuric acid, without allowing it to reach the terminal bulb. The flies were held for a minute or so to allow the acid to act. Insects treated in this way pitch headlong in attempted flight much as those whose halteres were removed. Some forty specimens were so treated. One of two conclusions seems necessary:—either the acid penetrates and essentially destroys the whole organ, or there is a special sensory portion which was destroyed and prevented the ordinary reaction.

The conclusions which the writer thinks reasonable are:

1. The halteres are necessary to successful balancing in flight in Diptera.

2. The peculiar and definite organs at the base are sense organs, and are necessary in giving the halteres functional value.

3. These sense organs are in some way aroused by the changes in position, and thru them the central nervous system is enabled to control the process of balancing.

A CONVENIENT DROPPER FOR USE IN CUTTING CELLOIDIN SECTIONS

A very useful aid in cutting celloidin sections is shown in the accompanying figure (Plate II). This piece of apparatus was in stock when the writer assumed charge of this laboratory, and he is not acquainted with its history. While it is not listed in any of the dealers' catalogs that the writer has examined, it may be made at a very slight cost in any machine shop.

It consists of a glass oil-cup (1) of about 40 cc. capacity, with a mill-head (2) at the top to regulate the flow of alcohol. The cup is fastened to a bar (3), which is slotted for about ¾ its length to receive the bolt that extends through the column (4) that holds the cup a few inches above the knife (5). The head of the bolt mentioned above is of the proper shape to fit into the slot in the knife-carrier, and the thumb-nut (6) on the other end of the bolt tightens at one time both the bar (3) to the column (4) and the column to the knife carrier. This thumb-nut and its bolt, which, except in length, are exactly those (7) that hold the knife in position, make it possible instantly to adjust the cup so that the alcohol will fall on any desired part of the knife; and since the apparatus is attached to the carrier it will always be over the same part of the knife even in microtomes where it is the knife that moves. If all the metal parts are nickel-plated it will obviate trouble in drying off the alcohol to prevent rusting.

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CRITICAL ILLUMINATION FOR THE MICROSCOPE

In a brief paper (J. Queck. Micr. Club. Nov. 1912) Reid gives some important suggestions for critical illumination, which will certainly be of value to beginners in the use of the microscope and to many older users who have not given critical attention to the sub-